

# LA-UR-22-20019

Approved for public release; distribution is unlimited.

**Title:** RCT Continuing Training: 1st Quarter 2022

**Author(s):** Gillilan, Justin Parker

**Intended for:** RCT Continuing Training

**Issued:** 2022-01-03



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

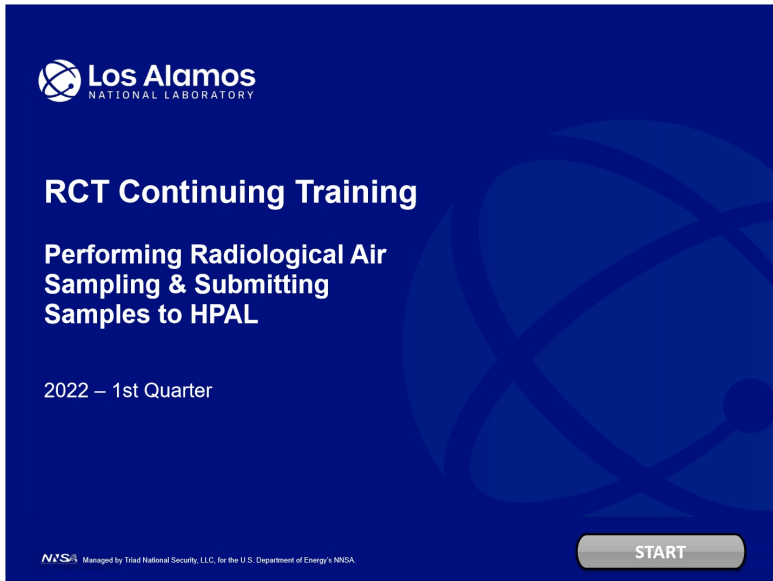
## **RCT Continuing Training: 1st Quarter 2022**

### **1. RCT Continuing Training 2022 1st Quarter**

#### ***1.1 RCT Continuing Training***

#### ***Performing Radiological Air Sampling & Submitting***

#### ***Samples to HPAL***



## 1.2 Introduction

### Introduction

Welcome to RCT Continuing Training.  
This training will discuss the process for:

1. Collecting and Evaluating Radiological Air Samples
2. Submitting Samples to HPAL

This training consists of viewing the online presentation and completing its associated exercise guide, UTrain Course #53850. It is recommended that you have the exercise guide with you while following along with the online training.



## 1.3 Terminal Objectives

### Terminal Objectives

- TO1: Given the need to perform radiological air sampling, recognize the requirements of P121, *Radiation Protection* and RP-PROG-TP-200, *Radiation Protection Manual*.
- TO2: Given the need to submit radiological samples to HPAL, recognize the requirements of P121, *Radiation Protection* and RP-PROG-TP-205, *Submitting Samples to HPAL*.





## 1.4 Enabling Objectives

### Enabling Objectives

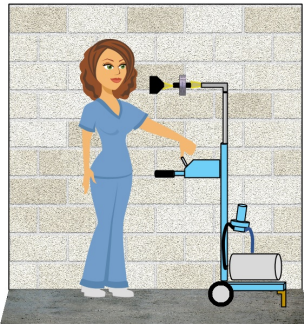
- EO1: Describe the process to perform an air sampler filter change
- EO2: Explain the operation of a Lo-Vol "Giraffe" air sampler
- EO3: Describe the process of an air sampler flow-rate verification
- EO4: Identify the considerations for air sampler placement
- EO5: Calculate DAC given HPAL air sample results
- EO6: Document air sample results
- EO7: Describe the process for submitting samples to HPAL



## 1.5 Lesson Navigation Page

### Lesson Navigation Page

#### 1. Radiological Air Sampling




#### 2. Submitting Samples to HPAL




Conclusion

## 1.6 Conclusion


### Conclusion



Congratulations! You have successfully completed the online portion of RCT Continuing Training. To receive credit for this training, you must now complete the Student Exercise Guide that has been provided to you. Once finished, email a copy of the completed guide to RP-Training@lanl.gov. Credit will be assigned for the exercise guide by the end of the quarter.



[EXIT COURSE](#)





## 2. Radiological Air Sampling

### 2.1 Radiological Air Monitoring

### Radiological Air Monitoring

Radiological air monitoring is performed to collect and analyze any potential airborne contaminants that workers or the public may be exposed to as a result of operations from radiological facilities. Airborne radioactivity is a concern due to the biological effects of ionizing radiation emitted by those contaminants. A comprehensive air monitoring program must be established to ensure all regulatory requirements are met and to control the intake of airborne radioactive material by workers. RCT's are responsible for correctly performing radiological air samples and for having the ability to interpret the results.







## 2.4 DAC-hr to Dose Estimation

### DAC-hr to Dose Estimation

Assuming a work year of 2000 hours (50 weeks x 40 hours/week)

2000 DAC-hr = 1 ALI = 5 rem = 5,000 mrem

Each DAC-hr of exposure = 5000 mrem / 2000 DAC-hr  
= 2.5 mrem / DAC-hr

- This thumb rule is used as an approximation to estimate dose received per DAC-hr exposed to. An actual dose calculation from bioassay monitoring should be performed to obtain an exposure report for an incident.



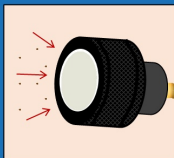
Los Alamos  
NATIONAL LABORATORY

## 2.5 Physical States of Airborne Radioactivity

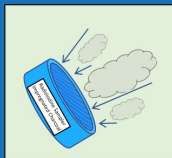
### Physical States of Airborne Radioactivity

Airborne radioactive contaminants are generally divided into three categories based on their physical state:

#### Particulates



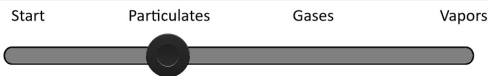
#### Gases



#### Vapors



The physical properties of airborne radioactive particles can affect inhalation deposition, their dynamic properties in air, and particle solubility in the lungs.



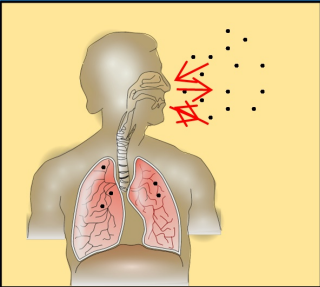
Los Alamos  
NATIONAL LABORATORY

Use the slider to navigate the physical states of airborne radioactivity


## Particulates (Slide Layer)


### Particulates

Particulate contaminants are solid and liquid particles, ranging in molecular sizes, which are suspended in air. Examples of solids include fumes, dusts, and smokes, and examples of liquids would be mists or fogs, depending on the dispersion of the liquid particulates. Retention of particulates in the lungs is highly dependent on their size and solubility. Dissolution of particles into the lungs allows them to enter the blood system and disperse throughout the body.



StartParticulatesGasesVapors

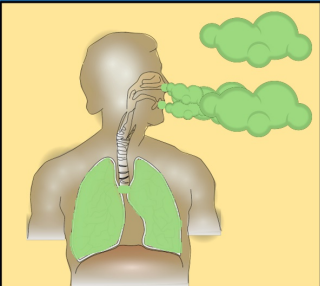


 *Use the slider to navigate the physical states of airborne radioactivity*


## Gases (Slide Layer)


### Gases

Gases are substances that, under normal temperature and pressure exists in a gaseous state. The retention of gases in the body from inhalation is poor, so, radioactive gases are usually treated as an external source of exposure. Examples of gases include fission product gases (xenon and krypton), and naturally occurring radon.



StartParticulatesGasesVapors

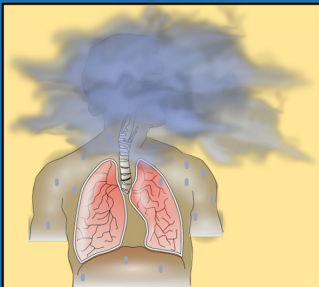


 *Use the slider to navigate the physical states of airborne radioactivity*

## Vapors (Slide Layer)

### Vapors

Vapor is considered the gaseous phase of a substance that is typically a solid or liquid under normal temperature and pressure conditions. The contaminant may be dispersed in a vapor form under abnormal conditions. As pressure and temperature return to normal conditions, the contaminant will return to a solid or liquid form. Absorption through the skin can be a concern with vapors. Tritium is an example of a radiological vapor contaminant.





Start

Particulates

Gases

Vapors






Use the slider to navigate the physical states of airborne radioactivity


## 2.6 Types of Air Samplers

### Types of Air Samplers

Air sampling equipment must be used where an individual is likely to receive an exposure of  $\geq 40$  DAC-hours/year and when directed by an RWP. There are different methods to sample for airborne radioactivity. The five primary types of samplers are:

- Personal air samplers (breathing zone)
- High-volume flow rate
- Low-volume flow rate
- Portable Continuous Air Monitors (CAM)
- Installed Continuous Air Monitors





## 2.7 Representative Sampling

### Representative Sampling

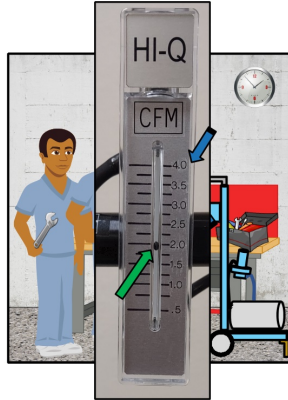
Radiological air sampling should be representative of what people in the vicinity are breathing. This is especially important while performing job coverage. One way to ensure this is done is to have the sampler flow rate obtain a volume approximate to the breathing rates of the individuals in that area.

#### Breathing Rates

Resting	12 LPM
Moderate work such as lifting, kneeling, squatting, and wearing a respirator	Up to 60 LPM

$$28.3 \text{ Liter} = 1\text{ft}^3 \rightarrow \frac{60 \cancel{\text{L}}}{\text{min}} \times \frac{1\text{ft}^3}{28.3 \cancel{\text{L}}} = 2.12 \text{ CFM}$$

Los Alamos  
NATIONAL LABORATORY



## 2.8 Low-Volume Air Samplers

### Low-Volume Air Samplers

The continuous duty constant flow air sampling system, often referred to as a giraffe or gooseneck, is a low-volume air sampler. This is frequently used in the radiation protection industry.

This model has a telescoping neck which is great for establishing breathing and work zone air sampling. It is designed to operate for extended periods of time, which makes it useful for general air monitoring for RMI's and job coverage.

Click the markers to read more on the features of this type of air sampler.


Los Alamos  
NATIONAL LABORATORY



"Giraffe" or "Gooseneck"  
Low-Volume Air Sampler



## 2.9 Portable Continuous Air Monitors



AMS-4 Beta CAM

### Portable Continuous Air Monitors

Continuous air monitors provide real-time monitoring to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material.

These real-time air monitors must have an alarm capability and enough sensitivity to alert potentially exposed individuals that immediate action is required to minimize or terminate inhalation exposures.

The Canberra Alpha Sentry and AMS-4 Beta CAMs are examples of continuous air monitors used at LANL.


## 2.10 Air Monitor Placement Determination

### Air Monitor Placement Determination

**RP-PROG-TP-200, 624.3**

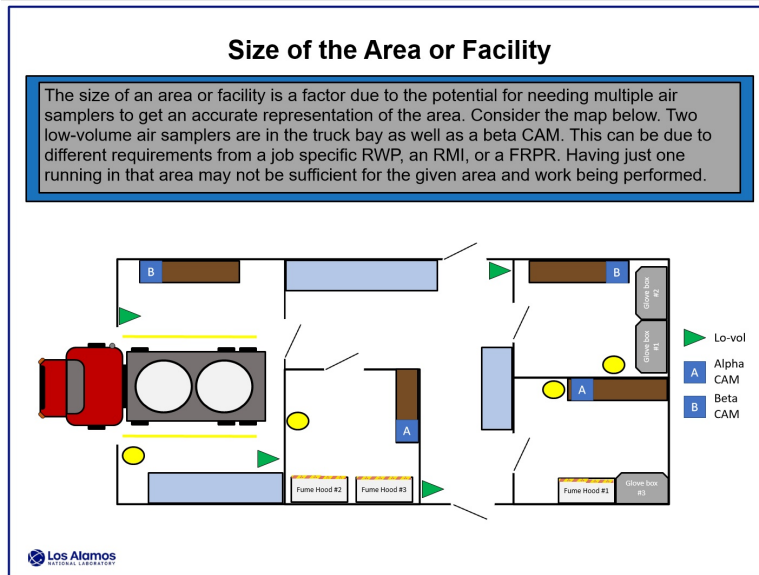
1. An air monitor placement determination is required when documenting baseline permanent air monitoring configurations.
2. If air monitoring is required in an RWP, then air monitor placement must be documented in the RWP package.
3. Consider the following when selecting the location and number of air samplers/monitors:

- Size of the area or facility
- Type of operations conducted at the facility
- Contamination levels and potential for contamination
- Traffic patterns
- Air flow patterns
- Facility features (ventilation intake locations, exhaust registers)
- Locations with high source-term potential
- Historical air monitoring results

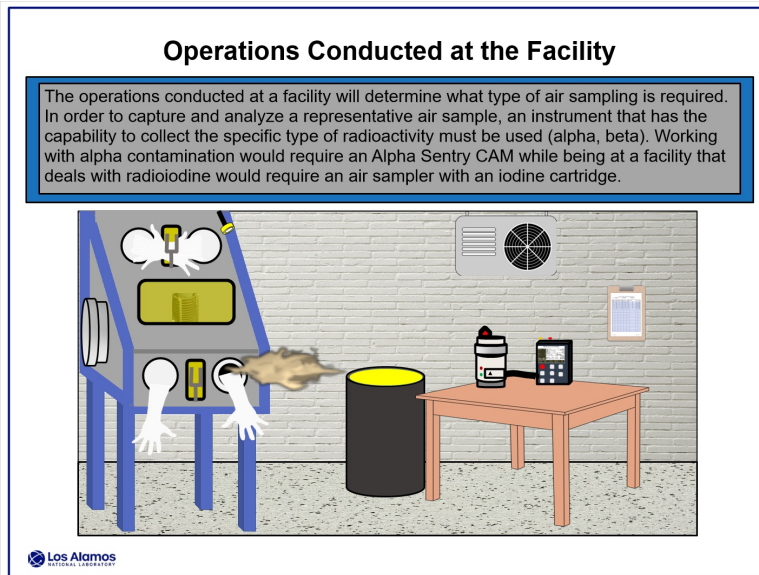




## 2.11 Size of the Area or Facility



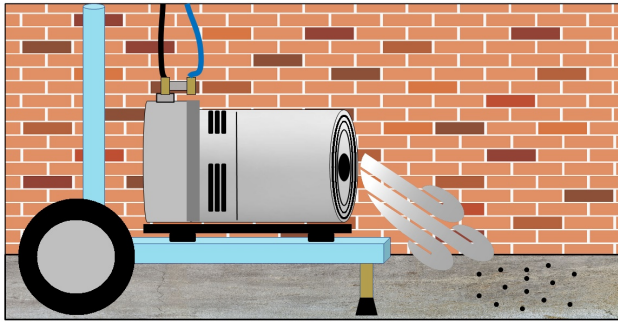
## 2.12 Operations Conducted



## 2.13 Contamination Levels in the Area

### Contamination Levels in the Area

Contamination levels of an area can be an issue when selecting air sampling equipment due to the potential of stirring up the contamination from the pump and motors. Starting up a low-volume or high-volume air sampler in an area of higher contamination can potentially create an Airborne Radioactivity Area. If an air sampler has to be used in a CA, good practice is to place it on a piece of yellow Herculite or Masslinn prior to starting.



Los Alamos  
NATIONAL LABORATORY

## 2.14 Traffic Patterns

### Traffic Patterns

Traffic patterns are a concern due to the potential of the air sampler becoming a tripping hazard or getting in the way of a worker while performing a job. An RCT should place it in an area that will get a representative sample while not being a danger to the people in the area. This is especially important while performing job coverage. Discuss with the workers prior to commencing the work to verify the sampler placement will not interfere with them.



Los Alamos  
NATIONAL LABORATORY

## 2.15 Airflow Patterns

### Airflow Patterns

Airflow patterns are conducted to get an idea of how air moves in that specific room or facility. The tests can be done with items such as a smoke stick or fog machine. Typically, airflow studies are done to establish a facility baseline on where air samplers should be stationed for long-term monitoring or job-specific evolutions. An RCT will not usually conduct these tests, but should understand that they exist and why they are conducted.

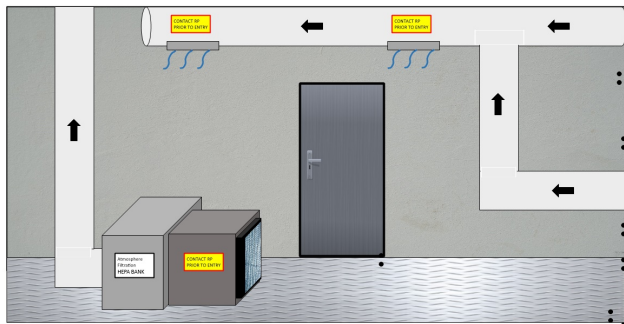


Los Alamos  
NATIONAL LABORATORY

## 2.16 Facility Features

### Facility Features

Facility features can provide an RCT guidance on where to place an air sampler by reviewing items such as air exhausts, supplies, and fans. Examining a room for these types of features can help an RCT understand the characteristics of where the air will travel, and better prepare them on where to place the air sampler. An RCT should also be aware of the possible effects of securing or starting the ventilation in the area as well.

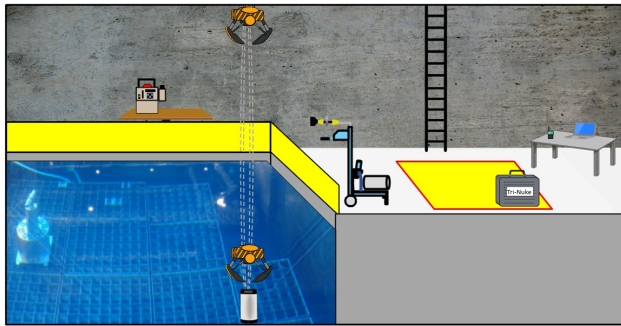


Los Alamos  
NATIONAL LABORATORY

## 2.17 High Source Term

### Locations with High Source Term Potential

A high source term location is an area that contains a large concentration of radioactivity, which if disturbed or compromised may lead to a radiological event from occurring. Examples of an area with a high source term potential are glove boxes, resin beds, and hot cells. Having air samplers in these areas can give workers early indications of an abnormal condition, or allow for airborne concentrations post-job to be determined.



Los Alamos  
NATIONAL LABORATORY

## 2.18 Historical Results

### Historical Results

Reviewing the historical results of airborne radioactivity levels is a great tool for an RCT to use. This data will improve planning and ensure proper measures are taken prior to starting the work. When an RCT is writing an RWP or preparing for job coverage, it is beneficial to review any previous air sampling data. Doing this can help verify RWP suspension limits are sufficient, and ensure proper PPE is being used.



Los Alamos  
NATIONAL LABORATORY

## 2.19 Match the Description to the Correct Term

*(Matching Drop-down, 10 points, unlimited attempts permitted)*

**Match the Description to the Correct Term**

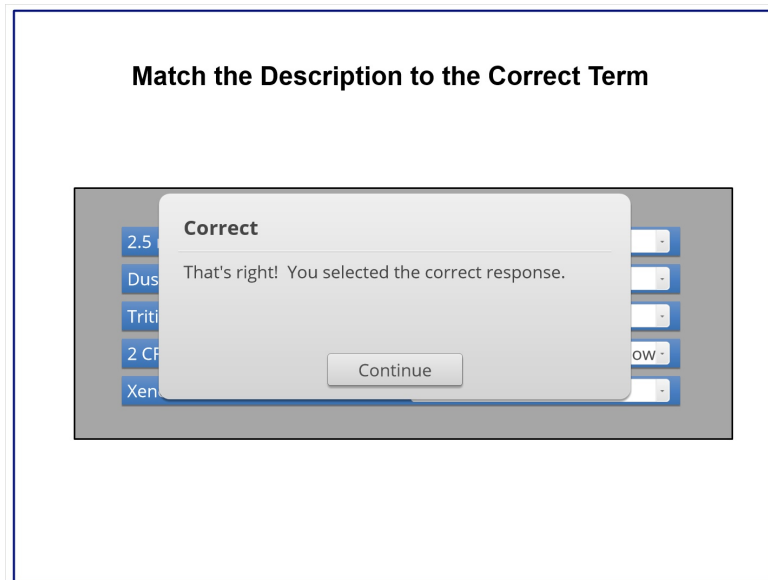
2.5 mrem	1 DAC-hr
Dust	Particulate
Tritium	Vapor
2 CFM	Low-Volume Air Sampler Flow
Xenon	Gas

Correct	Choice
2.5 mrem	1 DAC-hr
Dust	Particulate
Tritium	Vapor
2 CFM	Low-Volume Air Sampler Flow
Xenon	Gas

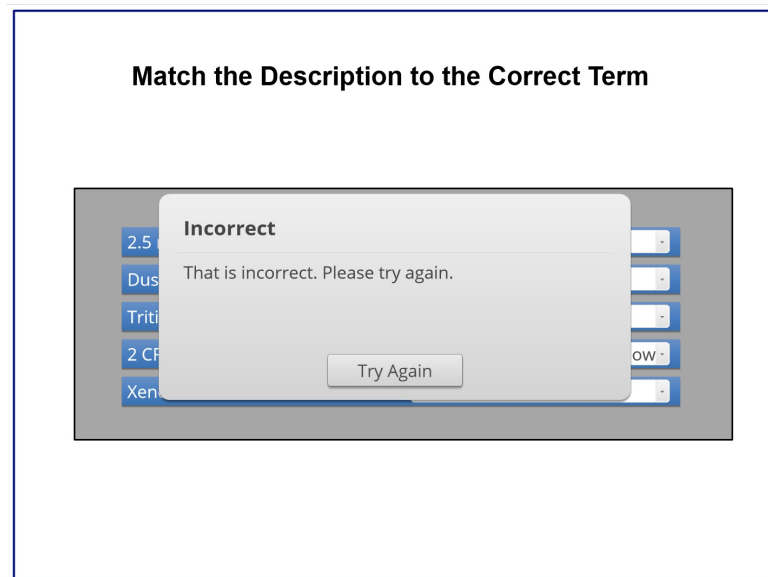
**Feedback when correct:**

That's right! You selected the correct response.

### Correct (Slide Layer)



### Try Again (Slide Layer)

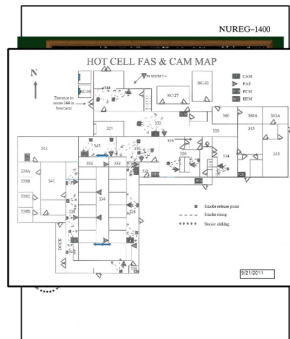


## 2.20 Air Monitor Placement

### Air Monitor Placement Determination

#### RP-PROG-TP-200, 624.3

4. Refer to NUREG-1400, *Air Sampling in the Workplace* for additional guidance in selecting placement of air sampling equipment.
5. If an airflow study is performed, then document the results using a map.
6. Air sampler inlets must be placed strategically (between workers and point of release, in appropriate air flow locations, in an area representative of breathed air).
7. If strategic placement of air samplers cannot be achieved, then breathing-zone monitoring must be performed.



## 2.21 Starting an Air Sample

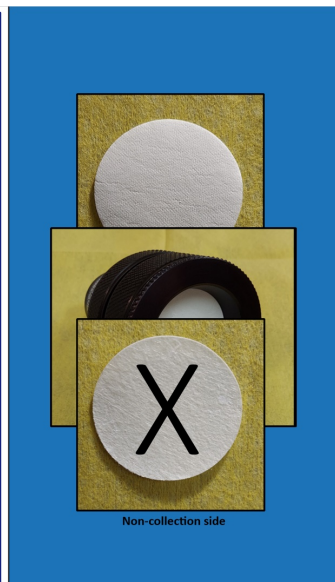
### Starting an Air Sample

Perform the following steps when preparing to conduct an air sample:

1. Obtain a new, clean air filter and mark the non-collection side with an "X". The collection side, as seen in the picture, has a surface that can be easily scraped off. While the non-collection side has a fibrous appearance and is difficult to remove.

**Do not use a marker that bleeds through the filter**

2. Remove the air sampler retaining ring from the sampler head and insert the new filter, ensuring any previous sampling material is removed. Remember to make sure the "X" is on the backside of the filter when placing it on the head.
3. Inspect the gasket/ring for damage or deterioration. Replace the air sampler retaining ring.



## 2.22 Starting an Air Sample

## Starting an Air Sample

4. Start the pump.
5. Note the time started and indicated flow rate on the sampler rotameter. Ensure flow is 2 CFM  $\pm$  0.25. Adjust the flow control valve to achieve this flow if needed. If flow cannot be maintained in this range, secure the pump, and tag out of service until a flow rate verification can be performed.
6. Record the air sample start date, time, and initial flow rate. This can be done on the air sample filter envelope, a logbook, or another facility specific recording process. HPAI requires these values to calculate the activity concentration of the air sample.



### 2.23 Flow Rate Verification

## Flow Rate Verification

**RP-PROG-TP-200, 624.5**

1. Flow rates for portable air samplers with rotameters must be verified annually at a minimum, and frequency must be included in facility Routine Monitoring Instructions (RMI).
2. If starting a new RP-PROG-FORM-020, *Air Sampler Flow Rate Verification*, then record the following:

- Date and time
- TA and building
- Calibration rotameter model
- Calibration rotameter number
- Rotameter calibration due date

[illegible]



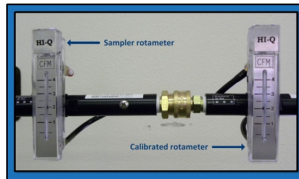
## 2.24 Flow Rate Verification

### Flow Rate Verification

3. For each air sampler, record the following in a new row:

- Room
- Air sampler number
- Required CFM (i.e. 2 CFM)

4. Verify the calibrated rotameter is within calibration.
5. Place a clean filter that is identical to the filter type used for air monitoring in the rotameter.
6. Remove the filter holder from the air sampler.
7. Ensure the air sampler rotameter is oriented within 15 degrees of the vertical position.



## 2.25 Flow Rate Verification

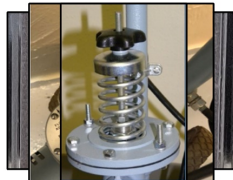
### Flow Rate Verification

8. Start the air sampler pump

#### CAUTION

Take rotameter readings at the middle of the floating ball

9. Record the calibrated rotameter CFM reading in the "As Found" column on RP-PROG-FORM-020.
10. The air sampler may either have a regulated air pump or flow control valve. Reference the associated section of RP-PROG-TP-200 to adjust the flow between 1.75 - 2.25 CFM.
11. If the air sampler rotameter does not read between this range, then remove the rotameter from service and inform the HPFC.
12. If the air sampler passed, then complete an air flow verification label and attach to the air samplers rotameter.

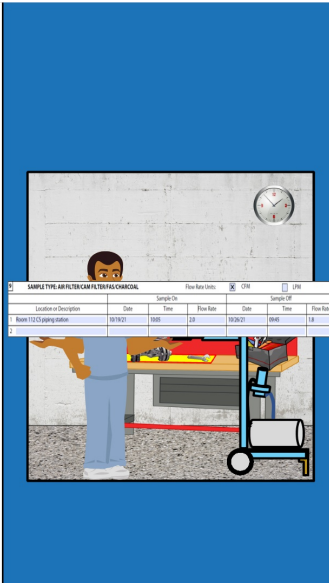


## 2.26 Collecting an Air Sample

### Collecting an Air Sample

When collecting an air sample, there are a few steps that need to be performed to ensure accurate results will be obtained.

1. Note the reading on the rotameter prior to securing the pump. These pumps, although designed for long-term continuous use, have a potential for the flow rate to drift up or down. Even a small fluctuation of 2.0 CFM to 1.8 CFM over a long period time can create a large difference in the total volume collected. Remember, HPAL needs the initial and final flow rates for the air sample activity concentration determinations.
2. Secure the pump and record the stop time, date and flow rate.



## 2.27 Collecting an Air Sample

### Collecting an Air Sample

3. Remove the air sampler retaining ring.
4. Remove the air filter from the sampler head using clean gloves or tweezers.
5. Place the filter in an envelope or tray.
6. Inspect the gasket/ring for damage or deterioration.
7. Place a new filter on the sampler head if a new sample needs to be started.
8. Replace the air sampler retaining ring.

**WARNING**  
Gloves must be worn when handling air samples

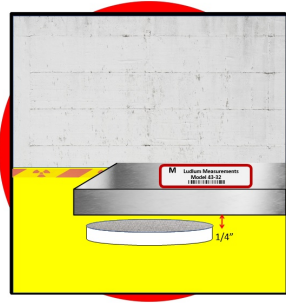


## 2.28 Field Screening

### Field Screening

A field screen of the air sample filter should be conducted to verify conditions of the area are as expected and to ensure HPAL limits are not exceeded. When performing a field screen, the following are best practices to prevent the spread of contamination and get an accurate reading.

- Do not perform while the filter is still in the sampler head. This does not allow the probe to get within 1/4" of the filter, contamination (loose and fixed) from the sampler head can give false readings, and background radiation levels in the area may not allow for a direct reading.
- Remove the air filter from the envelope in an area of low background, place the filter on a clean and flat surface. Frisk hands and change gloves when necessary.
- Using an appropriate contamination instrument, perform a frisk of the air filter at a distance of 1/4". Wait for counts to stabilize to obtain your reading.



Los Alamos  
NATIONAL LABORATORY

## 2.29 Value of Concern

### Field Screen Value of Concern

#### RP-PROG-TP-200, 624.4

9. If the field screen count rate is >4,000 dpm (combined alpha and beta), then recount the air filter after 30 minutes.
10. If the air filter count is <4,000 dpm after waiting 30 minutes, then submit the sample to HPAL. If the air filter count rate is still >4,000 dpm after 30 minutes, then notify the HPFC.

What is this 30 minute wait for?

Radon decay: Counts will decrease ~ 50% if the source is radon

As an RCT, you may encounter this short-lived naturally occurring radioisotope on a regular basis. Understanding where it comes from and how it decays can help an RCT better distinguish radon from actual contamination.

Los Alamos  
NATIONAL LABORATORY

## 2.30 Sources of Radon

### Sources of Radon

Radon is an inert gas that does not pose a significant health hazard. When taken into the body and lungs, the majority of it will be exhaled back into the environment. The concern with radon is the non-gaseous radioactive daughters that are produced from decay. These products can easily attach themselves to air, vapors, or particulates which can then be taken and retained in the body.

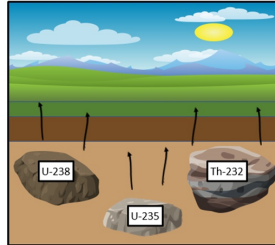
All naturally occurring heavy nuclides ( $Z > 83$ ) are part of one of the following series:

238 U - Radium

235 U - Actinium

232 - Thorium

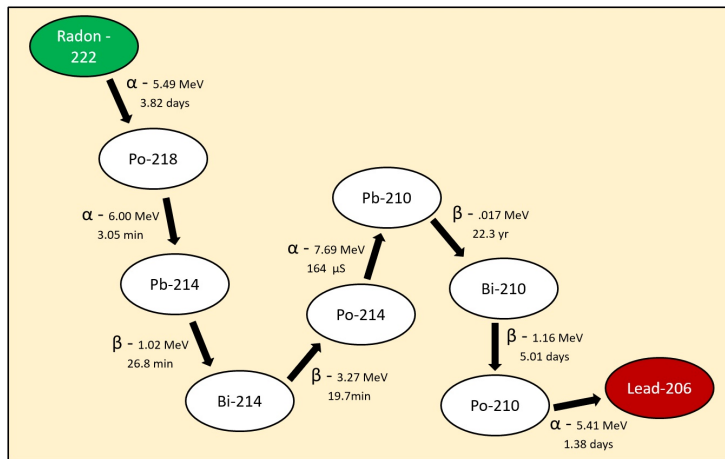
Each of these series contains a gaseous state of radon (Rn) and ends in a stable isotope of lead (Pb). Due to the very short-lived radon isotopes and the less commonly found Uranium-235, the Radium and Actinium series are not a major concern for radon concentrations detected by RCTs. The major contributor of radon is from the Thorium series.



Los Alamos  
NATIONAL LABORATORY

## 2.31 Rn-222 Decay Series

### Radon-222 Decay Series



Los Alamos  
NATIONAL LABORATORY

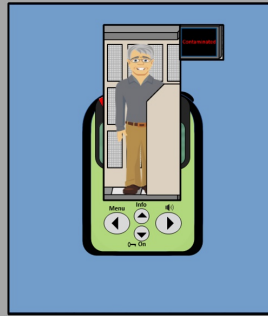
## 2.32 Radon Characteristics

### Radon Characteristics

The best way to determine whether the source of contamination is a result of radon is to wait and allow it to decay. However, radon does have certain characteristics that an RCT can use to decide if radon is the likely cause for elevated counts.

- Frequent PCM alarms on snowy days
- The detected contamination on an individual moves from location to location
- Both alpha and beta contamination are found

As an RCT, some of these radon traits will become more apparent over time. But it is important to never assume contamination found is from radon. Always follow facility specific guidance and consult with an HPFC if radon is suspected.



## 2.33 Submitting Air Samples to HPAL

### Submitting Air Samples to HPAL

After you have performed your field screen counts of the air filters it is time to submit your samples to HPAL for further analysis.

To properly document and transport the air samples, RP-PROG-TP-203 *Packaging and Transporting Requirements for RP Activities* and RP-PROG-TP-205 *Submitting Samples to HPAL* will need to be used. This process is discussed in the HPAL section of this training.



## 2.34 HPAL Results

### HPAL Results

After receiving the HPAL Analysis Report it is time to review the results.

HPAL ANALYSIS REPORT									
FILE: 29248057									
Sample Description		Analysis Information				Contact Information			
Login Date: 10/27/21		Instrument: Bert1 2010-AM				Name: MCTECH BILL			
Sample Type: Air Sample		Analysis: GrossAB				Phone: 867-8309			
Location TA:3 Bldg:006		Date: 10/29/21				Email: MCTECH@LANL.GOV			
Room: B100		Analyst: NEAL KELSEY N							
Priority: Routine									
Analyst Comments:									
Results not adjusted for energy, attenuation, or yield unless noted.									
Submitter Comments:									
None									
Sample ID	Alpha Activity	2 $\sigma$ Alpha sigma	Alpha Activity	Beta Activity	2 $\sigma$ Beta sigma	Beta NDA	Run Time	Flow Rate	
	(dpm/ml)	(dpm/ml)	(dpm/ml)	(dpm/ml)	(dpm/ml)	(dpm/ml)	(h)	(cfm)	
1	NDA	NDA	2.11	83.74	13.586	3.5	0.85	2.0	

The alpha activity for the air sample is NDA and the beta is 83.74. Notice that the units for this readout are in dpm/m<sup>3</sup>. To translate this activity into a DAC fraction we will need to convert these to  $\mu\text{Ci}/\text{mL}$  and then divide that value by the associated radionuclide DAC value.



## 2.35 Sample Unit Conversion

### Sample Unit Conversion

To convert the alpha or beta activity units to  $\mu\text{Ci}/\text{mL}$ , you will use the conversion equations shown here.

Now that the activity is in the correct units, it is time to compare them to the DAC value.

HPAL ANALYSIS REPORT									
FILE: 29248057									
Sample Description		Analysis Information				Contact Information			
Login Date: 10/27/21		Instrument: Bert1 2010-AM				Name: MCTECH BILL			
Sample Type: Air Sample		Analysis: GrossAB				Phone: 867-8309			
Location TA:3 Bldg:006		Date: 10/29/21				Email: MCTECH@LANL.GOV			
Room: B100		Analyst: NEAL KELSEY N							
Priority: Routine									
Analyst Comments:									
Submitter Comments:									
None									
Sample ID	Alpha Activity (dpm/ml)	2 $\sigma$ Alpha sigma (dpm/ml)	Alpha Activity (dpm/ml)	Beta Activity (dpm/ml)	2 $\sigma$ Beta sigma (dpm/ml)	Beta NDA (dpm/ml)	Run Time (h)	Flow Rate (cfm)	
1	NDA	NDA	2.11	83.74	13.586	3.5	0.85	2.0	



$$\text{dpm}/\text{m}^3 \rightarrow \mu\text{Ci}/\text{mL}$$

$$\begin{aligned} & \frac{(x) \text{ dpm}}{\text{m}^3} \times \frac{1 \mu\text{Ci}}{2.22\text{E}6 \text{ dpm}} \times \frac{\text{m}^3}{10^6 \text{ mL}} \\ & \frac{83.7 \cancel{\text{dpm}}}{\cancel{\text{m}^3}} \times \frac{1 \mu\text{Ci}}{2.22\text{E}6 \cancel{\text{dpm}}} \times \frac{\cancel{\text{m}^3}}{10^6 \text{ mL}} \\ & \frac{83.7 \mu\text{Ci}}{2.22\text{E}12 \text{ mL}} \\ & = 3.77 \times 10^{-11} \mu\text{Ci}/\text{mL} \end{aligned}$$

### 2.36 DAC Fraction Conversion

### DAC Fraction Conversion

A DAC Fraction is obtained from dividing the activity previously calculated by a DAC value. If the radioisotope(s) from the air sample is known, then this number can be found directly in 10CFR835, *Occupational Radiation Protection*, Appendix A, as shown below.

Department of Energy				Pt. 835, App. A			
Radionuclide	Absorption type <sup>1</sup>			Absorption type <sup>2</sup>			Stochastic or critical for use <sup>3</sup> (F/M/S)
	μCi/mL			Bq/m <sup>3</sup>			
	F	M	S	F	M	S	
Pu-235	—	9 E-05	8 E-05	—	3 E-06	3 E-06	E/ET/ET
Pu-238	—	1 E-01	7 E-01	—	6 E-01	3 E-01	E/ET/ET
Pu-237	—	1 E-06	1 E-06	—	1 E-04	6 E+04	S/S/S
Pu-239	—	1 E-12	5 E-11	—	2 E-04	1 E-03	S/S/S
Pu-240	—	5 E-12	1 E-11	—	2 E-01	2 E+00	S/S/S/S
Pu-241	—	1 E-12	1 E-11	—	1 E-01	1 E-01	S/S/S/S
Pu-242	—	2 E-10	2 E-09	—	1 E-01	1 E-02	S/S/S/S
Pu-243	—	9 E-12	1 E-11	—	1 E-01	1 E-01	S/S/S/S
Pu-244	—	5 E-12	5 E-11	—	1 E-05	1 E-05	E/E
Pu-245	—	5 E-12	1 E-11	—	2 E-01	2 E+00	S/S/S/S
Pu-246	—	9 E-12	1 E-11	—	3 E+03	3 E+03	S/S/S
Am-241	—	8 E-06	8 E-06	—	3 E-03	2 E-03	S/S/S
Am-242m	—	—	—	—	—	—	E/T/T
Am-242	—	2 E-06	—	—	9 E+04	—	S/S
Am-243	—	1 E-06	—	—	6 E+04	—	S/S
Am-244	—	7 E-07	—	—	2 E+04	—	S/S
Am-245	—	—	—	—	—	—	E/E



Los Alamos  
NATIONAL LABORATORY

### DAC for Unknown Radioisotopes

Beta emission	4 E-11 DAC $\mu\text{Ci/mL}$
Alpha emission	2 E-13 DAC $\mu\text{Ci/mL}$

$$\text{DAC-fraction} = \frac{\text{sample activity } (\mu\text{Ci/mL})}{\text{DAC value } (\mu\text{Ci/mL})}$$

$$\frac{3.77 \text{ E-11 } \mu\text{Ci/mL}}{4 \text{ E-11 } \mu\text{Ci/mL}}$$

DAC-fraction = 0.94

### 2.37 Multiple DAC Fractions

## Multiple DAC Fractions

There may be times when an air sample will have detected activity for both alpha and beta. To determine the DAC fraction when this occurs the same process as the previous example will need to be performed, and then the DAC fractions will be added together to get a total sum of DAC.

Sample ID	Alpha Activity	2* sigma	Alpha MDA	Beta Activity	2* sigma	Beta MDA	Run Time	Flow Rate
	(dpm/m3)	(dpm/m3)	(dpm/m3)	(dpm/m3)	(dpm/m3)	(dpm/m3)	(h)	(cm <sup>3</sup> /min)
1	8.09	7.504	6.7	124.75	13.586	11.71	0.25	2

Unknown Alpha	Unknown Beta
$\frac{8.09 \text{ dpm}}{m3} \times \frac{1 \mu\text{Ci}}{2.22 \text{ E}6 \text{ dpm}} \times \frac{m3}{10^6 \text{ mL}}$	$\frac{124.75 \text{ dpm}}{m3} \times \frac{1 \mu\text{Ci}}{2.22 \text{ E}6 \text{ dpm}} \times \frac{m3}{10^6 \text{ mL}}$
$\frac{8.09 \mu\text{Ci}}{2.22 \text{ E}12 \text{ mL}} = 3.64 \text{ E-12 } \mu\text{Ci/mL}$	$\frac{124.75 \mu\text{Ci}}{2.22 \text{ E}12 \text{ mL}} = 5.62 \text{ E-11 } \mu\text{Ci/mL}$
$\frac{3.64 \text{ E-12 } \mu\text{Ci/mL}}{2 \text{ E-13 } \mu\text{Ci/mL}} = 18.2$	$\frac{5.62 \text{ E-11 } \mu\text{Ci/mL}}{4 \text{ E-11 } \mu\text{Ci/mL}} = 1.4$
<p>Sum of DAC</p> <p>= DAC (α) + DAC (β)</p> <p>= 18.2 + 1.4</p> <p>= 19.6</p>	



Los Alamos  
NATIONAL LABORATORY

**2.38 The HPAL results for an air sample you submitted have come back with the final results of NDA for alpha, and 225 dpm/m<sup>3</sup> beta. This is from an unknown beta emitter. What is the DAC fraction?**

(Multiple Choice, 10 points, unlimited attempts permitted)

The HPAL results for an air sample you submitted have come back with the final results of NDA for alpha, and 225 dpm/m<sup>3</sup> beta. This is from an unknown beta emitter. What is the DAC fraction?

- ☐ 2.5
- ☒ 0.18
- ☐ 507
- ☐ 25

DAC for Unknown Radioisotopes	
Beta emission	4 E-11 DAC $\mu$ Ci/mL
Alpha emission	2 E-13 DAC $\mu$ Ci/mL

$$\frac{(x) \text{ dpm}}{\text{m}^3} \times \frac{1 \mu\text{Ci}}{2.22\text{E}6 \text{ dpm}} \times \frac{\text{m}^3}{10^6 \text{ ml}}$$

Correct	Choice
X	2.5
	0.18
	507
	25

**Feedback when correct:**

That's right! You selected the correct response.



## Correct (Slide Layer)

The HPAL results for an air sample you submitted have come back with the final results of NDA for alpha, and 225 dpm/m<sup>3</sup> beta. This is from an unknown beta emitter. What is the DAC fraction?

**Correct**

That's right! You selected the correct response.

Continue

$$\frac{(x) \text{ dpm}}{\text{m}^3} \times \frac{1 \mu\text{Ci}}{2.22\text{E}6 \text{ dpm}} \times \frac{\text{m}^3}{10^6 \text{ ml}}$$

## Try Again (Slide Layer)

The HPAL results for an air sample you submitted have come back with the final results of NDA for alpha, and 225 dpm/m<sup>3</sup> beta. This is from an unknown beta emitter. What is the DAC fraction?

**Incorrect**

That is incorrect. Please try again.

Try Again

$$\frac{(x) \text{ dpm}}{\text{m}^3} \times \frac{1 \mu\text{Ci}}{2.22\text{E}6 \text{ dpm}} \times \frac{\text{m}^3}{10^6 \text{ ml}}$$

## 2.39 Airborne Postings

### Airborne Postings

Knowing the DAC levels in an area is necessary to ensure proper measures are in place and the correct actions are taken if limits are exceeded. This may include the need to stop work due to an RWP suspension limit being exceeded, upgrading respiratory equipment with a higher protection factor, or posting a room as an Airborne Radioactivity Area (ARA).

Airborne Radioactivity Area	
Area Type	Air Concentration
Any accessible area where the concentration of airborne radioactivity, above natural background, exceeds or is likely to exceed the DAC values listed in Appendix A or Appendix C of 10 CFR 835	1 DAC
An area where an individual without respiratory protection could receive an intake exceeding 12 DAC-hr in a week	0.3 DAC (12 DAC-hr/40 hr)

As mentioned in the beginning of this lesson, airborne monitoring is a critical aspect in a Radiation Protection Program. RCTs need to know their procedural requirements when performing radiological air monitoring and have an understanding of the theory behind what they are doing.

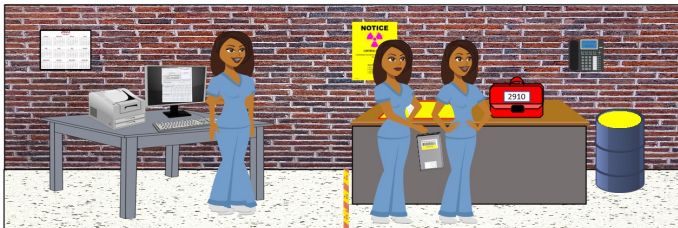


## 3. Submitting Samples to HPAL

### 3.1 Health Physics Analysis Laboratories

#### Health Physics Analysis Laboratories

The Health Physics Analysis Laboratories (HPAL) conducts radioanalytical services and bioassay monitoring. Non-destructive radioactive sample analyses are performed in support of LANL Radiation Protection and Environmental Stewardship programs. Some of the analytical capabilities include gross alpha/beta counting, liquid scintillation analysis, and isotopic analysis. RCT's are responsible for complying with the procedures of documenting, packaging, and submitting radiological samples to HPAL.



### 3.2 HPAL Location

#### HPAL Location



HPAL is located in TA-3, Building 2100

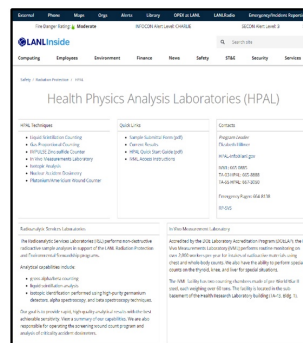


### 3.3 Accessing HPAL

#### Accessing HPAL

The HPAL webpage can be found on the Radiation Protection LANL Inside homepage. Here you can view the HPAL contact information, descriptions of the analytical capabilities, access to sample results, and a link for the HPAL Sample Submittal Form, RP-SVS-HPAL-001.

In this training, we will go over the requirements on how to prepare the samples, filling out the submittal form, what to do when arriving at HPAL, and how to track and log out your samples after they have been analyzed. To view HPAL results, the Radiation Protection Application Catalog can be used to access the HPAL data retrieval page.



Click the link to access the HPAL page



### 3.4 HPAL Sample Types and Analysis

	NuCon	Air Filter	Activity Report	LSC/H-3 Smear	Liquid	Oil	Nasal Smear	H-3 Air Filter	Charcoal Filter	Other
Gross $\alpha/\beta$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							Contact
Liquid Scint.				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Contact
Isotopic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Contact	Contact	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Contact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Leak Test	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>						<input checked="" type="checkbox"/>
Source Std.										<input checked="" type="checkbox"/>

### 3.5 HPAL Procedure

#### HPAL Procedure

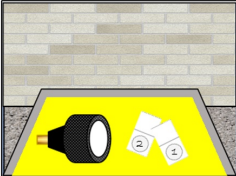
**RP-PROG-TP-205, Submitting Samples to HPAL**

This procedure provides the precautions and limitations of submitting samples to HPAL, guidance on sample preparation, batch preparation, and step-by-step instructions on how to fill out the HPAL Sample Submittal Form.

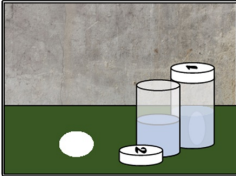
The different sample types covered in RP-PROG-TP-205 includes smears, air filters, liquid scintillation samples, charcoal filters, nasal smears, tape presses, and personal protective equipment samples.

### 3.6 Sample Preparation

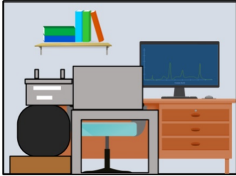
#### Sample Preparation



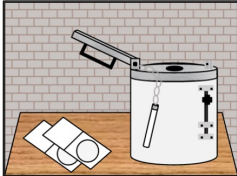
Total Alpha/Beta Activity



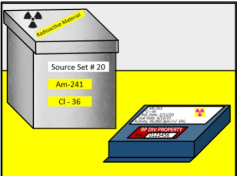
Liquid Scintillation



Isotopic Analysis




Leak Test



Source Standardization

Click the pictures above to see how these sample types are prepared

[NEXT](#)



### 3.7 Batch Preparation

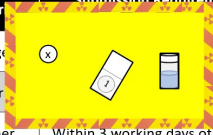
#### Batch Preparation


Now that we have reviewed how to prepare the sample, let's go over the process on how to submit the samples.


1. Separate samples into batches according to both the sample type (smears, air filters, liquids) and analysis.
2. If some of the samples within a batch will require an emergency or priority analysis, then prepare a separate batch for each priority type.

- Do not combine different sample types in a batch
- Do not combine different sample analysis types in a batch

Sample Priority	Submission Requirement
Emergency	Same shift
Priority	Next sample
Other	Within 3 working days of sample







### 3.8 Batch Preparation

Batch Type	Maximum Number of Samples
Gross Alpha/Beta Analysis	100
LSC Analysis	50
Isotopic Analysis	10

RP-PROG-TP-203	Revision: 0	Los Alamos
Effective Date: 06/01/2011	Next Review Date: 06/01/2014	
Environment, Safety, Health, Quality, Safeguards, and Security Directorate Radiation Protection Division Radiation Protection Programs		
RP-PROG Team Leader: Heidi W. Lurie	Organization: RP-PROG	Signature: Signature on file
RP-PROG Group Leader: Gary W. Schramm	Organization: RP-PROG	Signature: Signature on file
		Date: 08/29/2011
Users are responsible for ensuring they want to the latest approved version. To document a required read, login to <a href="#">L2/3/4</a> , and go to the relevant branch.		

#### Batch Preparation

- Ensure the number of samples within a batch does not exceed the HPAL maximum.
- Package each batch separately for transport per instructions in RP-PROG-TP-203, *Packaging and Transporting Requirements for RP Activities*.
- Place a sample tracking barcode on the primary container of the batch (plastic bag).

**NOTE 1:** When submitting disk smears, ensure each one is numbered and they are stapled together in groups of 10 (if applicable).

#### Notes:

### 3.9 Select the Correct Drop-Down Option

(Matching Drop-down, 10 points, unlimited attempts permitted)

#### Select the Correct Drop-Down Option

1. Remove any portions of the sample that are known not to have activity present.	Isotopic
2. Package/transport source standardization samples in accordance of RP-PROG-TP-203.	Source Standard
3. If source is accountable, place the RSSDMS ID number on submittal form.	Leak Test
4. Do not mark on smear/filter. Only write on cap.	LSC
5. Samples must be thin, flat, dry, and marked individually for identification.	Total Alpha/Beta Count

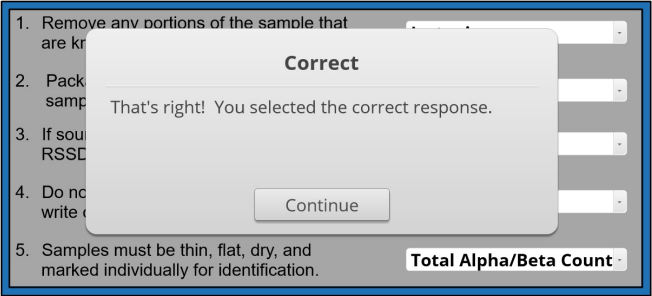
Correct	Choice
Remove any portions of the sample that are known not to have activity present.	Isotopic
Package/transport source standardization samples in accordance of RP-PROG-TP-203.	Source Standard
If source is accountable, place the RSSDMS ID number on submittal form.	Leak Test
Do not mark on smear/filter. Only write on cap.	LSC
Samples must be thin, flat, dry, and marked individually for identification.	Total Alpha/Beta Count

**Feedback when correct:**

That's right! You selected the correct response.

## Correct (Slide Layer)

**Select the Correct Drop-Down Option**



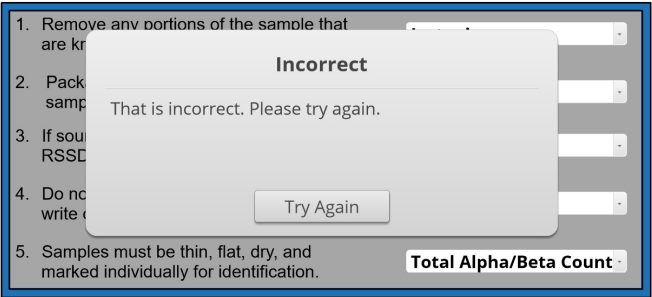
The screenshot shows a quiz interface with a list of five questions. A modal dialog box is open in the center, displaying the word 'Correct' in bold, followed by the text 'That's right! You selected the correct response.' and a 'Continue' button. The background is slightly dimmed. The questions are as follows:

- 1. Remove any portions of the sample that are known to be contaminated.
- 2. Pack samples in airtight containers.
- 3. If soured, use the RSSD.
- 4. Do not write on the container.
- 5. Samples must be thin, flat, dry, and marked individually for identification.

At the bottom right of the question list, there is a button labeled 'Total Alpha/Beta Count'.

## Try Again (Slide Layer)

**Select the Correct Drop-Down Option**



The screenshot shows the same quiz interface as above, but with a modal dialog box displaying the word 'Incorrect' in bold, followed by the text 'That is incorrect. Please try again.' and a 'Try Again' button. The background is slightly dimmed. The questions are the same as in the previous screenshot:

- 1. Remove any portions of the sample that are known to be contaminated.
- 2. Pack samples in airtight containers.
- 3. If soured, use the RSSD.
- 4. Do not write on the container.
- 5. Samples must be thin, flat, dry, and marked individually for identification.

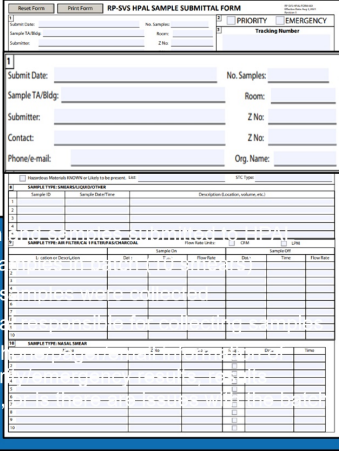
At the bottom right of the question list, there is a button labeled 'Total Alpha/Beta Count'.




### 3.10 HPAL Sample Submittal Form

#### HPAL Sample Submittal Form

1. Retrieve RP-SVS-HPAL-FORM-001 from the HPAL website or EDRMS.
2. Complete an HPAL submittal form for each batch.
3. Enter the following information in Block 1:




- Submit date of sample – Date form
- Number of samples – Number of sa
- Sample location – Location where s
- Submitter name and Z # – Individua
- Contact information - Name, Z #, p
- individual to be contacted with prior
- greater than notification thresholds.
- Deployed group (organization)




### 3.11 HPAL Sample Submittal Form

#### HPAL Sample Submittal Form

4. If the sample requires priority or emergency analysis, check the associated box.
5. Enter the sample tracking number.



- If completing the form manually, then place a sample tracking barcode sticker in Block 3 with the same barcode number as the sticker attached on the sample container and associated survey form
- If completing the form electronically, then type the same barcode number from the sample and survey
- Matching barcodes should be on the sample package (i.e plastic bag), HPAL submittal form, and associated survey (RP-PROG-FORM-114). Dispose of any extra barcode stickers



### 3.12 HPAL Sample Submittal Form

#### HPAL Sample Submittal Form

6. Select the sample type(s) and desired analyses in Block 4.
  - If multiple analyses are required for a sample type, then check all boxes that apply and add comments in Block 5.
7. If submitting samples for isotopic analysis, leak tests or source standardizations, then complete the nuclide information in Block 4.
  - a) Enter any known or suspected nuclides, or enter "See Below" and list the nuclides in Block 8, or enter "see attached" and list nuclides on an attached survey form.
  - b) Enter the total batch alpha and beta field screen results, or the highest individual sample alpha and beta field screen results, whichever is higher.

**NOTE 1:** Alpha and beta field screen results are required for isotopic analyses, and for known or suspect samples/batches exceeding the HPAL notification limits.



### 3.13 HPAL Sample Submittal Form

#### HPAL Sample Submittal Form

5

**Comments to HPAL**

Notify If: ☒ >NDA ☐ Other: \_\_\_\_\_

Perform isotopic analysis on positive samples

6 RPIN/RWP: 21-0015

8. If a prompt notification by HPAL of elevated results is required, then select the "> NDA" checkbox for notification of any positive results, or select the "Other" checkbox and enter a specific value for the contact "Notification Limit" in BLOCK 5.
9. Enter any additional analyses, comments or directions to HPAL in BLOCK 5. Examples include, "Return samples to submitter", or "Perform isotopic analysis on positive samples".
10. If samples are part of an RPIN, RWP, or work control document, then enter applicable information in BLOCK 6.

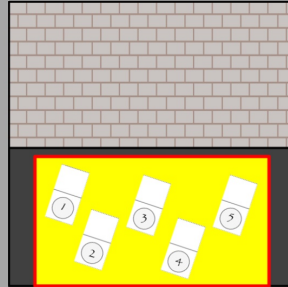


### 3.14 Notification Limits

#### HPAL Notification Limits

HPAL needs to be contacted prior to submitting any samples exceeding their notification limits. The use of field checks and historical data can help prevent these limits from being violated.

Type	Limit
Alpha Contamination	$\geq 5$ k dpm
Beta Contamination	$\geq 10$ k dpm
$\beta/\gamma$ Radiation	$\geq 0.5$ mR/hr on contact
Tritium Contamination	$\geq 400$ k dpm



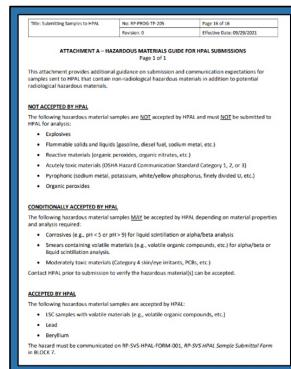
### 3.15 Hazardous Materials

#### Hazardous Materials

When submitting samples to HPAL, non-radiological hazards need to be considered as well. RP-PROG-TP-205, Attachment A – *Hazardous Materials Guide for HPAL Submissions*, lists the different types of materials accepted and not accepted by HPAL.

It is important to reference this procedure or to contact HPAL when unsure about whether a certain material may be sent for analysis.

If an approved hazardous material is going to be submitted, annotate this on the sample submittal form by selecting the box in Block 7 and list all known hazardous materials.

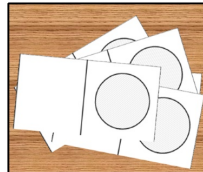


### 3.16 HPAL Sample Submittal Form

#### HPAL Sample Submittal Form

After filling out the previous sections of the submittal form, you will then complete the appropriate blocks based on the type of samples that are being submitted. Make sure all of the required information is filled in correctly and boxes checked, such as flow rate units and if a respirator was worn. These blocks include:

- Block 8 - Smears/Liquid Other
- Block 9 – Air Filter/CAM/FAS/Charcoal
- Block 10 – Nasal Smear



Remember, each form can only have one sample type and one analysis method selected. The backside of the submittal form contains extra spaces for sample information to be entered in case more room is needed. Once the form has been filled out it is now time to take the samples to HPAL.



### 3.17 What are the HPAL Notification Limits?

(Multiple Choice, 10 points, unlimited attempts permitted)

#### What are the HPAL Notification Limits?

- ☐  $\geq 5\text{k dpm alpha}$ ,  $\geq 50\text{k dpm}$  and  $\geq 0.2\text{ mR/hr beta gamma}$ ,  $\geq 500\text{k dpm tritium}$
- ☒  $\geq 5\text{k dpm alpha}$ ,  $\geq 10\text{k dpm}$  and  $\geq 0.5\text{ mR/hr beta gamma}$ ,  $\geq 400\text{k dpm tritium}$
- ☐  $\geq 2\text{k dpm alpha}$ ,  $\geq 5\text{K dpm}$  and  $\geq 5\text{ mR/hr beta gamma}$ ,  $\geq 100\text{k dpm tritium}$
- ☐  $\geq 20\text{ dpm alpha}$ ,  $\geq 1\text{k dpm}$  and  $\geq 0.5\text{ mR/hr beta gamma}$ ,  $\geq 100\text{k dpm tritium}$



Correct Choice

$\geq 5\text{k dpm alpha}$ ,  $\geq 50\text{k dpm}$  and  $\geq 0.2\text{ mR/hr beta gamma}$ ,  $\geq 500\text{k dpm tritium}$

X	>5k dpm alpha, >10k dpm and >0.5 mR/hr beta gamma, >400k dpm tritium
	>2k dpm alpha, >5K dpm and >5 mR/hr beta gamma, >100k dpm tritium
	>20 dpm alpha, >1k dpm and >0.5 mR/hr beta gamma, >100k dpm tritium

### Feedback when correct:

That's right! You selected the correct response.

### Correct (Slide Layer)

### What are the HPAL Notification Limits?

- ☐ ≥5k dpm alpha, ≥50k dpm and ≥0.2 mR/hr beta gamma, ≥500k dpm tritium
- ☒ ≥5k dpm alpha, ≥10k dpm and ≥0.5 mR/hr beta gamma, ≥400k dpm tritium
- ☐ ≥2k dpm alpha, ≥5K dpm and ≥5 mR/hr beta gamma, ≥100k dpm tritium
- ☐ ≥20 dpm alpha, ≥1k dpm and ≥0.5 mR/hr beta gamma, ≥100k dpm tritium

**Correct**

That's right! You selected the correct response.

Continue

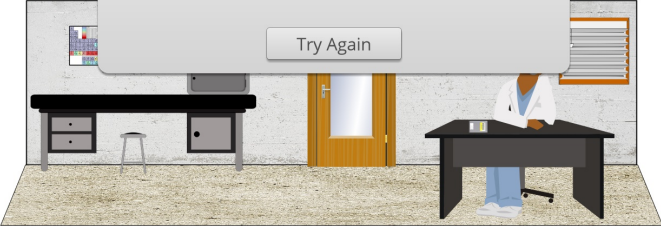
## Try Again (Slide Layer)

**What are the HPAL Notification Limits?**

- ☐  $\geq 5\text{k dpm alpha}$ ,  $\geq 50\text{k dpm}$  and  $\geq 0.2\text{ mR/hr beta gamma}$ ,  $\geq 500\text{k dpm tritium}$
- ☒  $\geq 5\text{k dpm alpha}$ ,  $\geq 10\text{k dpm}$  and  $\geq 0.5\text{ mR/hr beta gamma}$ ,  $\geq 400\text{k dpm tritium}$
- ☐  $\geq 2\text{k dpm alpha}$ ,  $\geq 50\text{k dpm}$  and  $\geq 0.2\text{ mR/hr beta gamma}$ ,  $\geq 500\text{k dpm tritium}$
- ☐  $\geq 20\text{k dpm alpha}$ ,  $\geq 50\text{k dpm}$  and  $\geq 0.2\text{ mR/hr beta gamma}$ ,  $\geq 500\text{k dpm tritium}$

**Incorrect**  
That is incorrect. Please try again.

Try Again




## 3.18 Packaging Solid HPAL Samples

**Packaging Solid HPAL Samples**

RP-PROG-TP-203, *Packaging and Transporting Requirements for RP Activities* provides guidance on how to transport the HPAL samples.

**Section 4.1.1 – Packaging Solid Samples**

1. Verify, if applicable, the total activity levels are less than the limits stated in 4.1.1, and take actions as described if levels are greater.
2. Place samples in sealable plastic bag(s).
3. Mark the bag with a CAUTION RADIOACTIVE MATERIAL label.
4. Place the bags in an RP-approved shipping container.
5. Perform an on-contact dose rate survey on the exterior of the container and note the readings. Verify  $< 0.5\text{ mrem/hr}$ . If levels are  $\geq 0.5\text{ mrem/hr}$ , take appropriate actions from the procedure.
6. Place a UN 2910 tag on the outside of the shipping container.



Do not place submittal form inside shipping containers

Los Alamos NATIONAL UNIVERSITY

### 3.19 Packaging Non-Tritium Liquid HPAL Samples

#### Packaging Non-Tritium Liquid HPAL Samples

##### Section 4.1.2 – Packaging Non-Tritium Liquid Samples

1. Verify, if applicable, the total activity levels are less than the limits stated in 4.1.2, and take actions as described if levels are greater.
2. Place absorbent material on the bottom of an RP approved shipping container.
3. Place samples in an RP-approved shipping container tray.
4. Mark the tray with a CAUTION RADIOACTIVE MATERIAL label.

##### CAUTION

Inner packaging containing liquids must be packaged and maintained with their closures upward (49CFR§173.24a(a)(1)).

5. Place tray in the shipping container and perform an on-contact survey on the outside of the container. Verify levels < 0.5 mrem/hr. Take similar actions as with solid samples levels exceeding 0.5 mrem/hr.
6. Mark the outside of the container with a UN2910 label.



### 3.20 Packaging Tritium Samples

#### Packaging Tritium Samples

##### Section 4.1.3 – Packaging Tritium Samples

##### CAUTION

- Tritium samples mixed with other radionuclides may NOT be packaged using instructions in this section.
- Inner liquid containers (vials, tubes, bottles, etc.) must NOT be filled more than  $\frac{3}{4}$  to the top to allow for expansion and prevent spilling when opened.

1. Verify, if applicable, the total activity levels are less than the limits stated in 4.1.3, and take actions as described if levels are greater.
2. Place absorbent material in the bottom of a durable, leak-proof container.
3. Place the samples in the container such that the samples are maintained with closures in an upright position during transport



Do not place submittal form inside shipping containers

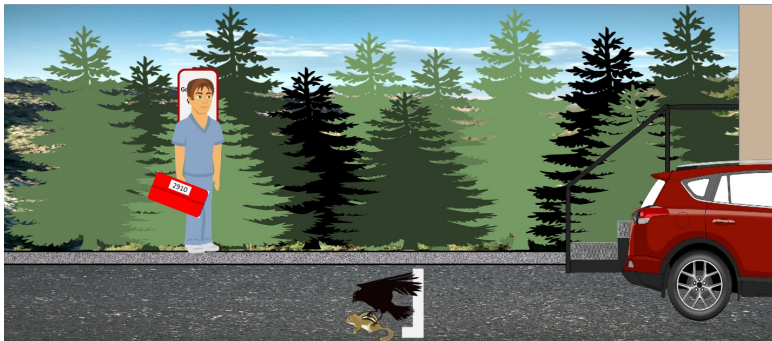




### 3.21 Transportation of Samples

#### Transportation of Samples

Transport the packages to their destination by hand-carrying the containers (walking), or via U.S. government vehicle. If transporting via government vehicle, then ensure all packages are secured within the vehicle. Maintain control of RAM samples, sources, and instruments at all times during transport. If a container is compromised during transportation or any anomalies occur, then immediately contact your HPFC for further actions.



### 3.22 Arriving at HPAL

#### Arriving at HPAL

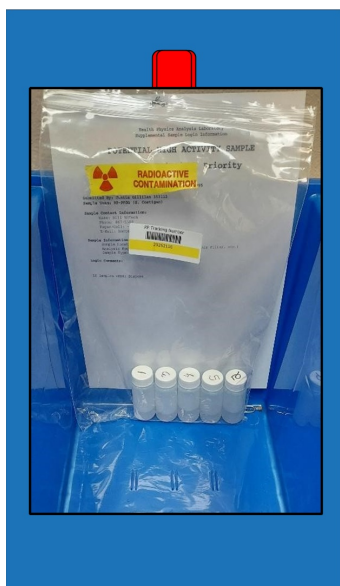
When arriving at HPAL with the samples and submittal form you will need to log them into the HPAL tracking system.

1. Scan your badge or type in your Z number
2. Select the Login Samples button
3. Fill in the sample information and batch priority
4. Enter the contact information for the sample
5. Indicate if any of the samples potentially of activity greater than the notification limits
6. Select the desired analysis
7. Request the actions to be taken if activity is detected
8. Select the sample type (smears, air filter)
9. Enter any comments for the analyzer or to appear on report
10. View and print summary page

A screenshot of the HPAL tracking system login form. The form contains the following fields and values: Barcode: 29262095; Number of Samples: 10; Location: RP-PROG (S. Costigan)/TA-0/Bldg; Priority: Priority; Contact Info: Bill McTech, Phone: 861-5309, Pager/Cell: , e-mail: bmcotech@lanl.gov; Analysis: GrossAB; Sample Type: NuCom; Comments: Instructions: Report; Positive Samples: Dispose. There are 'Edit' buttons next to the Location, Contact Info, Analysis, Comments, and Positive Samples fields. At the bottom of the form are 'Cancel' and 'Finish' buttons.



### 3.23 Sample Drop-Off



#### Sample Drop-Off

- Verify the information on the forms match and the point of contact can be reached when the analysis is complete
- Attach the Supplemental Sample Login Information sheet to the HPAL Submittal Form and the samples
- To prevent a spread of contamination, ensure the staple is above the sealing portion of the sample bag
- If the sample has a priority/emergency status, make sure that HPAL is aware prior to leaving
- Make sure all the samples are properly labeled and inside of a plastic bag (including liquids) when placing in the appropriate bins

### 3.24 Picking Up and Logging Out Samples

#### Picking Up and Logging Out Samples

HPAL will dispose of most low-level smears, air samples, and low-volume liquid waste after the analysis is complete. RCTs are expected to pick up their samples containing levels of higher contamination and larger liquid volumes, and to dispose of them according to their local facility guidelines. It is the responsibility of the RCT to log their sample out of the HPAL sample tracking system once they are collected or disposed of.

Over 200,000 samples are analyzed at HPAL in a given year. In order to create a smooth process, follow the guidance of RP-PROG-TP-203 and RP-PROG-TP-205 while submitting radiological samples, and reach out to the HPAL office whenever there is a question or concern.

Health Physics Analysis Laboratories (HPAL)																
<b>HPAL Techniques</b> <ul style="list-style-type: none"><li>• Liquid Scintillation Counting</li><li>• Gas Proportional Counting</li><li>• HPAL Zeroed/Calibrated Counter</li><li>• In Vivo Measurements Laboratory</li><li>• Sample Analysis</li><li>• Nuclear Accident Dosemetry</li><li>• Radiochemical Assay Method Counting</li></ul>	<b>Quick Links</b> <ul style="list-style-type: none"><li>• Sample Submittal Form (pdf)</li><li>• Current Results</li><li>• HPAL Quick Start Guide (pdf)</li><li>• HPAL Access Instructions</li></ul>	<b>Contacts</b> <table><tr><td>Program Leader</td><td>Elizabeth Wilson</td></tr><tr><td>HPAL Information (2017)</td><td></td></tr><tr><td>HPAL: 505-8858</td><td></td></tr><tr><td>Tx 03 HPAL: 605-8858</td><td></td></tr><tr><td>Tx 03 HPAL: 505-8858</td><td></td></tr><tr><td>Emergency Pages: 505-8818</td><td></td></tr><tr><td>HP 0015</td><td></td></tr></table>	Program Leader	Elizabeth Wilson	HPAL Information (2017)		HPAL: 505-8858		Tx 03 HPAL: 605-8858		Tx 03 HPAL: 505-8858		Emergency Pages: 505-8818		HP 0015	
Program Leader	Elizabeth Wilson															
HPAL Information (2017)																
HPAL: 505-8858																
Tx 03 HPAL: 605-8858																
Tx 03 HPAL: 505-8858																
Emergency Pages: 505-8818																
HP 0015																

### 3.25 Total Alpha/Beta Activity Samples

#### Total Alpha/Beta Activity Samples

1. Mark each sample individually for identification (e.g., number).
  - Do not use a marker that will bleed through the sample
  - Underline sample numbers that can be misread (6 and 9)
2. Ensure sample dimensions are less than 50 mm (2 inches) in diameter, or 50 mm at the greatest dimension (if not round).
3. Ensure all sample material is non-dispersible by removing any excess material that is not adhering to the sample media (dirt, oil, etc.).
4. If a sample is wet, then ensure media is allowed to dry before packaging.
5. If the side of the sample media to be analyzed is not apparent, then mark the non-active side of the sample.

**NOTE 1:** Samples submitted for total alpha/beta activity analysis must be thin, flat, and dry (e.g. smears and air filters).

**NOTE 2:** Suspect nuclides must be alpha emitters or beta emitters with maximum beta energies > 200 keV.



### 3.26 Isotopic Analysis Samples

#### Isotopic Analysis Samples

1. If submitting tritium or nasal smears for isotopic analysis, then contact HPAL for preparation instructions.
2. Remove any portions of the sample that are known not to have activity present. For example, remove sections of an LAS or PPE item with no activity.
3. Prior to packaging, perform a field screening measurement of the sample to determine the estimated activity.
4. Verify each sample is less than 70 mm (2.75") at its greatest dimension, or is easily compacted to this size.
  - If the sample cannot be reduced to this size, then contact HPAL
5. Package samples for isotopic analysis in individual bags and mark each bag individually for identification (number).

**NOTE 1:** Samples submitted for isotopic analysis include smears, air filters, liquids, oil, charcoal filters, PPE, etc.



### 3.27 Liquid Scintillation Samples

#### Liquid Scintillation Samples

1. Mark each LSC sample vial or other container individually (e.g., number).
  - Do not mark directly on smears or filters
  - Do not write on the side/bottom of the LSC vial, only write on cap
2. Ensure LSC vials are not leaking.
3. If submitting an oil sample, then provide at least 5 mL of oil.
4. If submitting a water sample, then provide at least 10 mL of water.

**NOTE 1:** *Leaking samples will be returned to the submitter unanalyzed.*

**NOTE 2:** *Sample types appropriate for LSC must be soluble or become transparent in the LSC cocktail. These include tritium smears, nasal smears, water samples, light colored oil samples, etc. Bulk samples **cannot** be analyzed by LSC. Acidic or basic (pH <5 or pH >9) samples **cannot** be accepted for LSC analysis.*

**NOTE 3:** *Suspect nuclides appropriate for liquid scintillation analysis include alpha emitters, low-energy beta (max. energy <200keV), and low energy photon (< 15keV) emitters.*



### 3.28 Source Standardizations

#### Source Standardizations

1. Leak check sources prior to submittal.  
Leaking sources will not be standardized by HPAL.
2. Identify nuclide(s) associated with each source on the submittal form.
3. Package and transport source standardization samples in accordance with RP-PROG-TP-203, *Packaging and Transporting Requirements for RP Activities*.



**NOTE 1:** *Sources requiring standardization include instrument calibration and check sources where knowledge of the true activity is required. Response check sources used only for their emission rate relative to a previous measurement normally do not require standardization.*



### 3.29 Leak Test Samples

#### Leak Test Samples

1. Collect and package leak test samples for analysis in accordance with applicable preparations sections, and the analysis guidance in Table 1.
2. Identify nuclide(s) associated with each source on the submittal form.
3. If the source is an accountable sealed source, then obtain the RSSDMS ID number for inclusion on the submittal form.

Radiation Type	Sample Type	Analysis
Alpha AND $\geq 200$ keV Beta	Smear (NuCon)	Total Alpha/Beta
	Swab	Liquid Scintillation
Gamma only	Smear/swab	Isotopic
Low-Energy Beta (< 200 keV) AND Low-Energy Gamma (< 115 keV)	Tritium smear/swab	Liquid Scintillation

Table 1

**NOTE 1:** *Leak test samples include smears taken from sources for leak-testing purposes.*

